Operating Instructions

for

Hand-held Conductivity

Measuring Units

Model: HND-C110

1. Contents

1. Contents....2
2. Note....3
3. Instrument Inspection....3
4. Regulation Use....3
5. Operating Principle....4
6. Electrical Connection....4
   6.1 Mains operation:....4
7. Operation / Configuration / Adjustments....4
   7.1 Safety Requirements....4
   7.2 Connections....5
   7.3 Pushbuttons....6
   7.4 Device Configuration:....8
   7.5 The Conductivity Measuring Cell....10
   7.6 Error and System Messages....11
   7.7 The Serial Interface....11
8. Maintenance....13
   8.1 When to replace battery....13
9. Technical Information....13
10. Order Codes....15
   10.1 Accessories....15
11. Declaration of Conformance....16

Manufactured and sold by:

Kobold Messring GmbH
Nordring 22-24
D-65719 Hofheim
Tel.: +49(0)6192-2990
Fax: +49(0)6192-23398
E-Mail: info.de@kobold.com
Internet: www.kobold.com

2. Note

Please read these operating instructions before unpacking and putting the unit into operation. Follow the instructions precisely as described herein.
The devices are only to be used, maintained and serviced by persons familiar with these operating instructions and in accordance with local regulations applying to Health & Safety and prevention of accidents.

When used in machines, the measuring unit should be used only when the machines fulfil the EWG-machine guidelines.

3. Instrument Inspection

Instruments are inspected before shipping and sent out in perfect condition.
Should damage to a device be visible, we recommend a thorough inspection of the delivery packaging. In case of damage, please inform your parcel service / forwarding agent immediately, since they are responsible for damages during transit.

Scope of delivery:
The standard delivery includes:

- Hand-held Conductivity Measuring Units Model: HND-C110
- Operating Instructions

4. Regulation Use

Any use of the Hand-held Conductivity Measuring Units, model: HND-C110, which exceeds the manufacturer's specification may invalidate its warranty. Therefore, any resulting damage is not the responsibility of the manufacturer. The user assumes all risk for such usage.

5. Operating Principle

The KOBOLD hand-held conductivity measuring units of the HND-C110 model are compact conductivity measuring units with solidly connected probes that can be used universally. Due to the double display, both the conductivity and the temperature value can be displayed simultaneously. Both HND-C models (HND-C105/HND-C110) offer functions like minimum/maximum value memory, hold function, auto-off function, and AutoRange (automatic adjustment of the optimum measuring range).
Due to the high temperature dependency in conductivity measurement, both hand-held measuring units have automatic temperature compensation.
With the improved housing design HND-C110, the determination of resistance, salinity, and TDS are also part of the scope of functions.

6. Electrical Connection

6.1 Mains operation:

When using a power supply unit please note that operating voltage has to be 10.5 to 12 V_{DC}. Do not apply over-voltage !! Simple 12 V-power supply units often have excessive no-load voltage. We, therefore, recommend using regulated voltage power supply units. Trouble-free operation is guaranteed by our power supply HND-Z002. Prior to connecting the plug power supply unit with the mains supply make sure that the operating voltage stated at the power supply unit is identical to the mains voltage.

7. Operation / Configuration / Adjustments

7.1 Safety Requirements

This device has been designed and tested in accordance with the safety regulations for electronic devices. However, its trouble-free operation and reliability cannot be guaranteed unless the standard safety measures and special safety advises given in this manual will be adhered to when using the device.

1. Trouble-free operation and reliability of the device can only be guaranteed if the device is not subjected to any other climatic conditions than those stated under chapter 9. Technical Information.
2. If the device is transported from a cold to a warm environment condensation may cause a failure of the instrument. In such a case make sure the device temperature has adjusted to the ambient temperature before trying a new start-up.

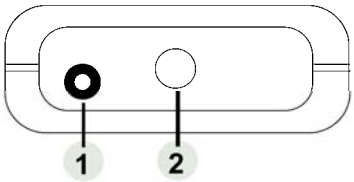
3. If the device is to be connected to other devices (e.g. via serial interface) the circuitry has to be designed most carefully. Internal connection in third party devices (e.g. connection GND and earth) may result in not-permissible voltages impairing or destroying the device or another device connected.

Warning: If device is operated with a defective mains power supply (short circuit from mains voltage to output voltage) this may result in hazardous voltages at the device (e.g. sensor socket, serial interface).

4. If there is a risk whatsoever involved in running it, the device has to be switched off immediately and to be marked accordingly to avoid re-starting.
   - there is visible damage to the device
   - the device is not working as specified
   - the device has been stored under unsuitable conditions.

In case of doubt, please return the device to manufacturer for repair or maintenance.

7.2 Connections

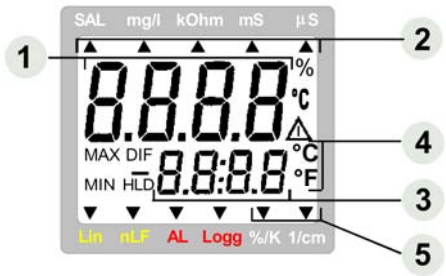


1 **Interface**: Connection for electrically isolated interface adaptor (accessories: HND-Z031)

2 **Electrode**: cable gland for fixed conductivity electrode

The mains socket is located at the left side of the instrument.

7.2.1 Displays



1 **Main display**: conductivity, resistivity, filtrate dry residue (TDS), salinity or user prompt

2 Display of **measuring value units** for main display

3 **Secondary display:** temperature or configuration settings

4 **Measuring value units** for temperature

5 **Units** for configuration settings

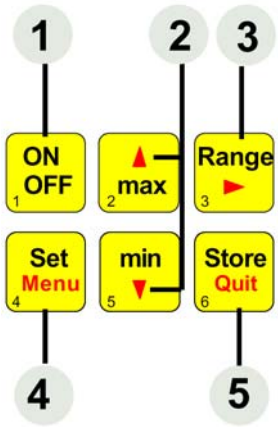
7.2.2 Special Display Elements

1 **MAX/MIN/HLD:** indicates if min., max. or HOLD values are displayed in the main or secondary display

2 **Warning triangle:** indicates low battery

3 **Lin/nLF:** indicates temperature compensation set

7.3 Pushbuttons



1 **On/off key**

2 **min/max for measurements:**
press shortly: indication of min. or max. value measured so far as well as corresponding temperature
press for 2 sec.: delete min./max. values

3 **Set/Menu**: to enter values or change settings
Range: for conductivity measuring only
press for 2 sec.: change between automatic and manual measuring range selection
press shortly for manual measuring range selection: change to widest measuring range or change from highest to smallest measuring range

4 **Set/Menu:**
press shortly (Set): change-over between measuring units: conductivity, resistivity of fluid, filtrate dry residue (TDS) and salinity
press for 2 sec. (Menu): configuration will be activated

5 **Store/Quit:**
measurement: holding of current meas. value ('HLD' in display)
Set/Menu: acknowledge setting, return to measuring

7.3.1 Selection of Measuring Unit:

The device allows a choice between the various measuring units, i.e. conductivity, resistivity of fluid, filtrate dry residue ('Total Disolved Solids') and salinity. To do so press Set Menu-key for a short time. The measuring value of the current measuring unit will be shown in the upper line of the display, the corresponding device will be indicated by an arrow at the top corner of the display. Simultaneously, the temperature is shown in the lower line of the display at all measuring units.

7.3.2 Change Between Measuring Range Resolutions:

For measuring conductivity you have a choice between four different measuring range resolutions:

0.0 .. 200.0 µS/cm
0 .. 2000 µS/cm
0.00 .. 20.00 mS/cm
0.0 .. 200.0 mS/cm

If Auto-Range is switched on the HND-C110 will automatically choose the optimum resolution. If Auto-Range is switched off you can change to the next measuring range resolution by pressing the Range-key for a short time.
In case you have already been working in the highest resolution range, pressing of the key will bring you down to the lowest measuring range resolution. The corresponding measuring unit is shown by an arrow in the top right-hand corner of the display.

To activate/deactivate Auto-Range function press Range-key press for 2 seconds. The Auto-Range function set will be shown in the display as long as the Range-key is being pressed.

7.3.3 Salinity measuring:

The salinity (salt content) of seawater can be determined in the measuring mode „SAL“ (basis: International Oceanographic Tables; IOT)
The salinity of standard-seawater is 35 ‰ (35 g salt per 1 kg seawater).
The values are displayed in ‰ (g/ kg).

7.3.4 Minimum and Maximum Values:

The min. or max. value of the current measuring unit will be shown in the upper line of the display after the max - or min keys have been pressed for a short time. The lower display line will simultaneously show the temperature at which the max./min. values for conductivity or resistivity, filtrate dry residue, salinity have occurred. To switch over between the max./min. values of the measuring units press Set for a short time. Max./min. values for conductivity, resistivity, filtrate dry residue and salinity will be recorded even though the measuring unit is not shown in the display at the moment. To delete max./min. values press max-key or min-key for approx. 2 seconds.

7.4 Device Configuration:

For configuration of the device press Set Menu-key for 2 seconds.

Choose between the individual values that can be set by pressing the Set Menu- key again.

The individual values are changed by pressing the keys max or min.

Use Store Quit to leave configuration and to store settings.

7.4.1 't.Cor': Selection of Temperature Compensation

max
min

off: no temperature compensation selected

nLF: non-linear temperature compensation for natural water acc. to EN27888 (DIN 38404)
To measure ground water, surface water, drinking water and purest water.

Lin: linear temperature compensation for other aqueous solutions

To measure the TDS value always use non-linear temperature compensation for natural water (reference temperature = 25 °C). To measure salinity the instrument automatically switches over to the non-linear temperature compensation acc. to IOT (reference temperature = 15 °C).

7.4.2 't.Lin': Setting of Temperature Coefficient (only when t.Cor = Lin)

max
min

0.300 .. 3.000: Temperature compensation coeeficient in %/K. For any aqueous solution to be measured the relevant factor has to be established beforehand.

7.4.3 't.rEF': Selection of Reference Temperature (only when t.Cor = nLF or Lin)

max
min

20 °C / 68 °F: reference temperature 20 °C (68 °F)
25 °C / 77 °F: reference temperature 25 °C (77 °F)

7.4.4 'C.tdS': Setting of TDS-factor

max
min

0.40 .. 1.00: calculation factor for TDS-measurements

The calculation factor depends on the composition of the medium and has to be determined for each type of water.

7.4.5 'CELL': Setting of Cell Correction

0.800 .. 1.200: cell correction

The cell correction may change due to natural ageing or depositions at the fixed measuring cell. In case you have an accurate reference liquid, you may adjust the HND-C110 by changing the cell correction accordingly.

Factory setting of the cell correction is 1.000.

7.4.6 'Unit t': Selection of Temperature Unit

°C: All temperature values in degrees Celsius

°F: All temperature values in degrees Fahrenheit

7.4.7 'OFFS': Selection of Temperature Offset

-2.0 .. 2.0 °C: / **or** / **-3.6 .. 3.6 °F:** The zero point of the temperature measurement will be displaced by this value (temperature displayed = temperature measured - offset). The offset is used to compensate for deviations.

off: Zero displacement has been deactivated (=0.0°)

7.4.8 'P.off': Selection of Power-off Delay

1...120: Power-off delay in minutes. The instrument will be automatically switched off as soon as this time has elapsed if no key is pressed/no interface communication takes place.

off: automatic power-off function deactivated (continuous operation, e.g. in case of mains operation)

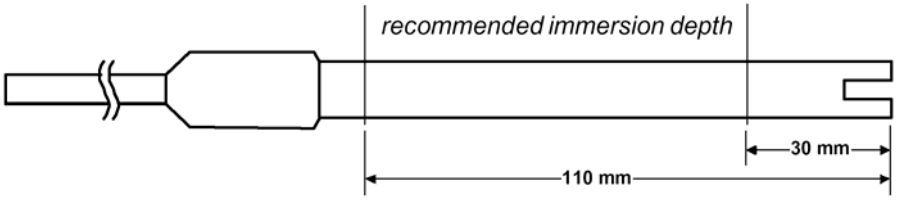
7.4.9 'Address': Selection of Base Address

01, 11, 21, ..., 91: Base address for interface comunication. Channel 1 will be addressed by the base address set, channels 2 and 3 will have the following addresses.
(Example: base address 21 - channel 1 = 21, channel 2 = 22, channel 3 = 23)

Using an interface converter it is possible to connect several devices to a single interface. As a precondition the base addresses of all devices must not be identical. In case several devices will be connected via one interface make sure to configurate the base addresses accordingly.

7.5 The Conductivity Measuring Cell

During the measurement, the conductivity measuring cell must be dipped into so far, that at least 30 mm beginning from the top of the measuring cell, is located in the medium.
The maximum immersion depth for continuous operation should be 110 mm.



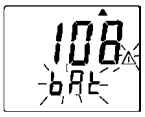
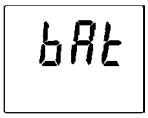
The measuring cell can either be stored in vertical position dry or in water. After dry storage wetting time will be prolonged slightly. If changing over from one liquid to another with conductivities varying widely make sure to properly rinse and shake dry measuring cell.

Measuring cell must never come into contact with water-repellent materials such as oil or silicone.

If conductivity measured is much higher or lower than expected this may be due to the electrode being soiled with non-conducting or conducting foreign materials. Measuring cell has to be cleaned with a watery soap solution.

When measuring media with low conductivities the electrode has to be moved sufficiently.

7.6 Error and System Messages

Display	Description	Remedy
	Low battery voltage, device will only continue operation for a short time	replace battery
	Low battery voltage If mains operation:	replace battery replace power supply, if fault continues to exist: device damaged
no display or confused characters	Battery voltage too low If mains operation: power supply defective or wrong voltage/polarity System error Device defective	replace battery check/replace power supply disconnect battery or power supply, wait for a short time, re-connect return to manufacturer for repair
Err.1	Values exceeding meas. range	Check: are there any values exceeding the specified meas. range? - measuring instrument not suitable! cable of measuring cell defective -> replace
Err.2	Values falling below meas. range	Check: are there any values falling below the specified meas. range? - measuring instrument not suitable! cable of measuring cell defective -> replace
Err.7	System fault	disconnect battery, wait for 10 sec. and re-connect battery, switch on device once again. If fault continues to exist device is defective -> return to manufacturer for repair.
Er.11	Value could not be calculated	A measuring variable device required for calculation is faulty (overflow/underflow)

7.7 The Serial Interface

All measuring and setting data of the device can be read and changed by means of the serial interface and a suitable electrically isolated interface adapter (HND-Z031). In order to avoid transmission errors, there are several security checks implemented.

The following **standard software packages** are available for data transfer:

-**BUS-SW9M:** 9-channel software to simultaneously display conductivity (channel 1), temperature (channel 2), resistivity (channel 3), TDS (channel 4) and/or salinity (channel 5).

If you want to use the interface functions make sure to switch off the Auto-Range function.

7.7.1 The following interface functions will be supported

Conductivity	Temperature	Resistance	TDS	Salinity		
Channel	Channel	Channel	Channel	Channel	DLL-Code	Name/Function
1	2	3	4	5		
x	x	x	x	x	0	Read nominal value
x	x	x	x	x	3	Read system state
x	*1	x	x	x	6	Read min. value
x	*2	x	x	x	7	Read max. value
x					12	Read ID no.
x					13	Assign new address
					14	Read address
x					174	Delete min. value
x					175	Delete max. value
x	x	x	x	x	176	Read min. measuring range
x	x	x	x	x	177	Read max. measuring range
x	x	x	x	x	178	Read unit for measuring range
x	x	x	x	x	179	Read decimal point for measuring range
x	x	x	x	x	180	Read measuring type
x					194	Set display unit
x					195	Set decimal point of display
x	x	x	x	x	199	Read measuring type of display
x	x	x	x	x	200	Read min. display range
x	x	x	x	x	201	Read max. display range
x	x	x	x	x	202	Read unit of display
x	x	x	x	x	204	Read decimal point of display
x					208	Read channel count
	x				216	Read offset correction
	x				217	Set offset correction
x					222	Read power-off delay
x					223	Set power-off delay
x					240	Reset unit
x					254	Read program identification

*1 = temperature of the min conductivity value
*2 = temperature of the max conductivity value

8. Maintenance

8.1 When to replace battery

1) If ⚠ and ´bAt´ are shown in the lower display the battery has been used up and needs to be replaced. The device will, however, operate correctly for a certain time. If ´bAt´ is shown in the upper display the voltage is too low to operate the device; the battery has been completely used up.

Please note: The battery has to be taken out, when storing device above 50 °C. We recommend to take out battery if device is not used for a longer period of time.

2) Treat device and sensor carefully. Use only in accordance with above specification. (do not throw, hit against etc.).
   Protect plug and socket from soiling.
3) To disconnect sensor plug do not pull at the cable but at the plug. Don't connect electrode canted! When connecting the probe the plug will slide in smoothly if the plug is entered correctly. If plug is entered incorrectly the connecting pins of the plug can be damaged. => Plug can no longer be used and connecting cable needs to be replaced.

9. Technical Information

Measuring principle:	2-electrode conductivity measuring cell with temperature sensor integrated into the shaft Electrode material: graphite
Measuring range:	
• Conductivity	0.0...200.0 µS/cm 0...2000 µS/cm 0.00...20.00 mS/cm 0.0...200.0 mS/cm (manually adjustable or automatically)
• Temperature	-5.0...+100.0 °C
Accuracy:	(± 1 digit, at nominal temperat. 25 °C)
• Conductivity	±0.5 % MV ±0.3 % FS or ±2 µS/cm
• Temperature	±0.2 % MV ±0.3 K

Resolution:	
• Conductivity	0.1 µS/cm, 1 µS/cm, 10 µS/cm or 0.1 mS/cm
• Temperature	0.1 °C
• Resistance	0.001 k., 0.01 k. or 0.1 k.
• Salinity	0.1
• TDS	1 mg/L
Display:	two 4-digit LC-displays
Operating temp.:	0 to +50 °C (housing), Meas. cell: -5 to +80 °C (continuous) to +100 °C (short-term)
Storage temp.:	-20 to +70 °C
Storage humidity:	0 to +95 % rH (non-condensing)
Electrode:	2-electrode conductivity measuring cell with temperature sensor integrated into the shaft. Electrode material: graphite, solidly mounted with 1 m cable
Output:	serial interface (via 3-pin jack, transformer on RS232 or USB optional)
Power supply:	9 V-monobloc battery (included in the scope of delivery), external 10.5-12 V_{DC} via jack
Material:	housing made of impact-resistant ABS plastic
Protection:	IP 65, front
Dimensions:	housing 142 x 71 x 26 mm (H x W x D), electrode max. Ø approx. 12 mm, length approx. 120 mm
Weight:	approx. 255 g (incl. battery and electrode)

Scope of functions:
Min-/Max value memory
Hold function: »freezing« of the current value
Automatic-off function: 1...120 min (can be deactivated)
AutoRange: Automatic measuring range adjustment
(can be deactivated)
Automatic temperature compensation
Replace battery display

Additional functions
- Resistivity, salinity, and TDS-determination
- Temperature coefficients that can be selected:
  Natural water, linear compensation or no compensation
- Increased temperature measuring range

10. Order Codes

Order-no.	Housing design
HND-C110	Conductivity measuring unit with additional functions (see 9. Technical Information)

10.1 Accessories

Order-no.	Description
HND-Z002	Plug power supply (220/240 VAC, 50/60 Hz), 10.5 VDC / 10 mA
HND-Z021*	Case with recess (275 x 229 x 83 mm)
HND-Z022*	Universal case with egg crate foam (275 x 229 x 83 mm)
HND-Z023*	Large case with recess (394 x 294 x 106 mm)
HND-Z031	Interface converter on RS232, galvanically isolated
HND-Z032	Interface converter on USB, galvanically isolated
HND-Z033	Adapter RS232 converter on USB-interface
BUS-SW9M	Software for recording measurement data on a computer, for instruments of the HND-series without logger function

*observe instrument dimension

Additional accessories upon request.

11. Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Hand-held Conductivity Measuring Units Model: HND-C110

to which this declaration relates is in conformity with the standards noted below:

EN 55 022 **6/1993 class B**
EN 50 082-1 **IEC1000-4-6, IEC1000-4-4, IEC1000-4-3, IEC1000-4-2**

Also the following EEC guidelines are fulfilled:

89/336/EEC, 92/31/EEC, 93/68/EEC **EMC Directive**
73/23/EWG, 93/68/EWG

Hofheim, 30. October 2007

H. Peters
General Manager

M. Wenzel
Proxy Holder